

## TEST ANXIETY INTERVENTIONS FOR CHILDREN AND ADOLESCENTS: A SYSTEMATIC REVIEW OF TREATMENT STUDIES FROM 2000–2010

NATHANIEL VON DER EMBSE

*East Carolina University*

JUSTIN BARTERIAN

*Michigan State University*

NATASHA SEGOOL

*University of Hartford*

High-stakes tests have played an increasingly important role in how student achievement and school effectiveness are measured. Test anxiety has risen with the use of tests in educational decision making. Students with high test anxiety perform poorly on tests when compared to students with low test anxiety. School psychologists can play an important role as experts both in tests and measurement and mental health in providing consultation and treatment for students with test anxiety. This article describes the results of a systematic literature review of the last 10 years of test-anxiety interventions. Results indicate that there are few studies that have examined test-anxiety interventions with elementary and secondary school students. However, techniques including biofeedback, behavior therapy, cognitive behavioral therapy, priming competency, and mixed approaches have demonstrated promising results. Suggestions are made for school psychologists for the delivery of evidenced-based test anxiety interventions. © 2013 Wiley Periodicals, Inc.

Educational testing plays an increasingly important role in decision making through the measurement of individual student achievement and overall school performance. Legislation, such as the No Child Left Behind Act (NCLB, No Child Left Behind Act of 2001, P.L. 107–110 C.F.R.) requires schools to test students annually in third grade through eighth grade, and once in high school. The pervasiveness of “high-stakes” tests in the United States necessitates a close examination of the impact of test anxiety on test performance and careful evaluation of effective treatments for test anxiety that may be used to buffer the adverse effects of test anxiety on student test performance. Educators are under pressure to meet yearly achievement targets, with all student subgroups expected to achieve 100% proficiency by the 2013–2014 school year. If schools do not meet these annual targets, a variety of sanctions may occur, including allowing students to transfer to other schools, offering free tutoring, replacing the entire school staff, or having the State Department of Education take over the school district. Despite the high-stakes decisions and consequences derived from the results of standardized achievement testing, there are several factors that may interfere with the accurate measurement of student achievement on these tests, including test anxiety (Putwain, 2008).

Test anxiety has been defined as the emotional, physiological, and behavioral responses surrounding the potential consequences of negative evaluation on an upcoming test or exam (Zeidner, 1998). Recent work by Lowe and colleagues suggests that biopsychosocial factors, including biological (e.g., physiological arousal), psychological (e.g., emotional or cognitive factors), and social (e.g., parent pressure), contribute to development and expression of test anxiety (Lowe & Lee, 2008; Lowe et al., 2008). In association with these factors, students with test anxiety exhibit interfering thoughts, feelings, or off-task behaviors in testing situations that are perceived to be personally relevant (Cizek & Burg, 2006). Additionally, when a test-anxious student perceives a test to be

---

Correspondence to: Nathaniel von der Embse, Department of Psychology, East Carolina University, Greenville, NC 27858. E-mail: [vonderembse@ecu.edu](mailto:vonderembse@ecu.edu)

threatening and performs less than optimally, that student's maladaptive cognitions are reinforced and test anxiety increases.

It has been estimated that between 10% and 40% of all students suffer from various levels of test anxiety (Gregor, 2005), and students with disabilities, women, and minority students report higher rates of test anxiety (Putwain, 2007; Rosairio et al., 2008; Sena, Lowe, & Lee, 2007; Zeidner, 1990). Test anxiety has been reported to onset as early as age 7 (Connor, 2003), and when present, test anxiety is a disruptive factor in students' academic careers. Students with high levels of test anxiety perform lower on tests and have lower overall academic achievement as measured by grade point averages (McDonald, 2001; Raffety, Smith, & Ptacek, 1997; Segool, Carlson, Goforth, von der Embse, & Barterian, 2013; Sena et al., 2007).

Despite the prevalent and disruptive nature of test anxiety, research on test anxiety has declined since the 1970s and the majority of current test anxiety research takes place outside of the United States (Ziedner, 1998). However, there continues to be important advances in our understanding of test anxiety and effective interventions for treating it. Test anxiety interventions have generally consisted of either antecedent interventions or anxiety reduction interventions. Accommodations and modifications to the testing method, such as team testing and portfolio assessments, have been offered as alternatives designed to reduce/avoid test anxiety (Hurren, Rutledge, & Garvin, 2006). Test anxiety intervention research has primarily examined the effects of cognitive-behavioral methods and skill-building interventions to reduce test anxiety and improve test performance (Gregor, 2005; Sapp & Farrell, 1994); however, the small sample sizes of most studies limit the generalizability of findings (von der Embse, 2011).

Although now more than a decade old, the most recent published meta-analysis evaluating the effectiveness of test anxiety interventions was undertaken by Ergene (2003). This meta-analysis examined psychology and education research indexes (e.g., ERIC, PsychINFO, Digital Dissertation Abstracts) and identified 39 published studies and 17 unpublished studies from 1973 to 1998 that included a control group, random assignment, and test anxiety outcome data. Behavioral ( $n = 45$ ;  $ES = .80$ ) and cognitive ( $n = 16$ ;  $ES = .63$ ) approaches were effective in reducing test anxiety; combined approaches such as behavioral-skill-based ( $n = 4$ ,  $ES = 1.10$ ) or cognitive-skill-based ( $n = 2$ ,  $ES = 1.22$ ) produced the highest effective sizes (Cohen, 1988; Ergene, 2003). A large majority of the treatment groups included in the review focused on university students ( $n = 76$ ) and only 12 treatment groups included elementary and high school students. Because university students are not representative of K-12 students (i.e., those students who attend higher education are generally high achievers), results from this meta-analysis may not be applicable to K-12 students.

As indicated by Ergene (2003), there is a lack of research on test anxiety intervention programs designed for elementary, middle, and high school students. Similarly, Hembree (1988) suggests that test anxiety has become an increasing concern among K-12 students. Therefore, a critical review of effective test anxiety interventions for kindergarten through 12th-grade students is paramount. The goal of this article is to address this void by systematically evaluating test anxiety intervention research from 2000 to 2010 with the goal of synthesizing the literature on effective test anxiety interventions for school-aged youth so that school psychologists are best prepared to support the success of students with test anxiety.

## METHODS

The authors conducted a preliminary review of evidence-based treatments for generalized anxiety disorders in youth to serve as a foundation for a more narrow and systematic review of test anxiety interventions. Treatments for generalized anxiety disorders have been characterized

in several modalities including self-control desensitization, self-monitoring, applied relaxation or progressive muscle relaxation, and cognitive restructuring (Borkovec & Costello, 1993). A meta-analysis by Borkovec and Whisman (1996) identified behavioral techniques (e.g., relaxation training) that generally had higher effect sizes than cognitive-type therapies. However, combined approaches (e.g., cognitive-behavioral treatments with anxiety-management training) were found to be most effective in a meta-analysis by Gould and colleagues (Gould, Otto, Pollack, & Yap, 1997). In sum, although behavioral interventions and cognitive interventions were both found to be effective in treating generalized anxiety disorders, combined approaches appear to be most efficacious. The evidence-based practices identified for generalized anxiety disorders were compared to the test anxiety treatments identified in the present review.

A comprehensive literature review was conducted in order to identify relevant articles that address the treatment of test anxiety among K–12 students using three prominent electronic databases in psychology and education (PsycInfo, PsycArticles, and ERIC). The search was restricted to studies published in English, peer-reviewed journals between 2000 and 2010. Group studies and single-case designs that were quasi-experimental or experimental were included. Search terms included: test anxiety, exam anxiety, test stress, exam stress, intervention, and treatment. The initial search yielded 92 results. Next, a multistep procedure was used to identify articles that qualified for inclusion in this study. First, two authors (NvE and JB) reviewed article titles and abstracts to determine whether the studies evaluated a test anxiety intervention or treatment procedure, resulting in 40 potential articles. Second, these 40 articles were reviewed independently to determine whether the studies described an intervention or treatment procedure for test anxiety among kindergarten through 12th-grade students. Thirteen articles were identified through this method, with an interrater reliability of 98%. When disagreement occurred, the authors reviewed the article together and came to an agreement regarding study inclusion until 100% agreement was achieved. For example, the Cheek, Bradley, Reynolds, & Coy (2002) article was not included in the review after both authors agreed the methodology was not empirical in nature and lacked the required pre- and postintervention data collection. Finally, three articles were excluded from the current study because they did not contain specific outcome data on student test anxiety from pre- to posttreatment.

Results indicated that only 10 studies evaluated the efficacy or effectiveness of test anxiety intervention/treatment programs in comparison to no treatment with kindergarten through 12th-grade children in the last 10 years, with nine studies finding promising results in reducing test anxiety. All of the studies identified focused on adolescent and high school students, except for Larson and colleagues (2010) who examined the use of an intervention among third-grade students, and Faber (2010) who examined the use of an intervention among third- through ninth-grade students. Interventions were delivered internationally, with four studies implemented in the United States, two in Germany, and one each in Great Britain, India, Israel, and Nigeria. Study designs and effect sizes are summarized in Table 1. Effect sizes were calculated for studies with a pre–post design and between group designs.

Effect sizes, which is a standardized metric used to compare effectiveness, were calculated for each study included in the review. The effect size indicates the level of difference in standard deviations between a within-group sample's scores on a given measure from pre- to posttreatment or a between-group study's scores on a given measure across the treatment and control groups. In interpreting the magnitude of the effect, Cohen categorized effect sizes as small ( $d \leq 0.20$ ), medium ( $d = 0.50$ ), or large ( $d \geq 0.80$ ) (Cohen, 1988). Effect sizes were calculated using formulas from Lipsey and Wilson (2001), which are summarized in the following.

Table 1  
Summary of Reviewed Studies

First Author, Year	n & Student Characteristics	Intervention Focus & Methodology	Design & Duration	Treatment Measures, Effect Size (Positive ES Indicates Change in the Desired Direction)
Bradley et al., 2010	n = 136  Age: Mean: 15.3 Grade: 10th Location/setting United States; two large high schools in Northern California	Focus: Emotion-focused techniques to control stress and test anxiety  Methodology: Teacher administered, classroom format. <i>Resilient Educator Program</i> : Professional development sessions for teachers regarding the Freeze-Framer intervention and teaching/implementing biofeedback techniques. <i>TestEdge Intervention</i> : Teachers instruct students in coherence-building tools and technologies to improve test preparation, retention of material, and awareness of emotions. <i>Freeze-Framer Interactive Learning System</i> : Biofeedback computer program that provides heart rate data in order for participants to apply relaxation techniques to achieve heart rate coherence	Quasi-experimental with a wait-list control  12, 20-minute sessions, 2-day teacher training	Treated (vs. untreated) high test anxiety students showed a number of significant treatment effects:  Student Opinion Survey (SOS): Negative affect, d = .68 California Standards Test (CST) Psychophysiological measures under stress: Other 6 subscales, NS Test Anxiety Inventory (TAI): Modified: English language, NS Global, d = .84 Worry, NS Emotionality, d = 1.21 Coherence, d = 1.81
Carter et al., 2005	n = 38	Focus: Test-taking skills	Quasi-experimental design	Two treated groups showed increased achievement and one group showed decreased test anxiety

(Continued)

Table 1  
Continued

First Author, Year	n & Student Characteristics	Intervention Focus & Methodology	Design & Duration	Treatment Measures, Effect Size (Positive ES Indicates Change in the Desired Direction)
Egbochuku & Obodo, 2005	n = 78 Age: 15–19, with IEPs Grade(s): High school Location/Setting: United States; large urban district	Methodology: Researcher administered, group format. <i>Test Taking Strategy Instruction</i> : Academic skill building intervention where the interventionist teaches students the following six test-taking strategies: bubble sheet completion and timing, sorting problems, estimation, substitution and backsolving, recopying problems, and elimination  Focus: Reduction of anxiety during test taking	6, 90-minute lessons  Randomized design, with a no-treatment control 12, 30-minute sessions	Test Anxiety Inventory (TAI) Simulated Tennessee Competency Achievement Program Emotion Grp 1, NS; Grp 2, d = .53 Worry, Grp 1, NS; Grp 2, NS Total, Grp 1, NS; Grp 2, d = .48 Math, Grp 1, d = .54; Grp 2, d = .54 Systematic desensitization treated (vs. untreated) high test anxiety students showed significant treatment effects: Test Anxiety Inventory (TAI), Nigerian version Global, d = .70

(Continued)

Table 1  
Continued

First Author, Year	<i>n</i> & Student Characteristics	Intervention Focus & Methodology	Design & Duration	Treatment Measures, Effect Size (Positive ES Indicates Change in the Desired Direction)
Faber, 2010	<i>n</i> = 21	Focus: Academic strategies for spelling	Quasi-experimental, with a wait-list control	Students receiving training showed significant pre-post treatment effects according to the author:
	Age: Unreported Grade: 3rd–9th, with dyslexia Location/setting: Germany	<i>Methodology</i> : Unknown leader, individual format. <i>Academic Strategy Instruction</i> : Consisted of a training sequence that included visual algorithms and verbal self-instructions for determining spellings of words	80, 60-minute sessions	Spelling achievement Performance, $d = 3.56$ Test anxiety: Worry and emotionality author-scale Spelling-specific, $d = 1.93$
Gregor, 2005	<i>n</i> = 105	Focus: Reduction of anxiety during test taking	Quasi-experimental, with three experimental conditions and one attention control	Students receiving treatment showed some significant pre-post effects. <i>ES could not be calculated.</i>
	Age: 16–17 Grade: Year 11 Location/setting: Great Britain: Upper school	<i>Methodology</i> : Teacher and researcher administered, classroom format. <i>Relaxation Techniques</i> : Focused on positively addressing anxiety feelings, awareness of body and breathing, identifying the feelings of stress, and using specific relaxation skills to reduce stress. <i>Cognitive Behavioral Therapy (CBT)</i> : Included information on how thoughts can influence feelings, addressing negative cognitions surrounding test taking, and replacing negative thoughts with positive and useful cognitions. <i>Mixed</i> : Consisted of both relaxation and CBT interventions	5, 45-minute sessions	Friedben Test Anxiety Scale (FTA) Student report, NS across all groups General Certificate of Secondary Education (GCSE) Exam Mixed group alone performed better than expected Conner's Rating Scales Relaxation, CBT, and Revised – Systematic Behavioral control groups were less anxious. Mixed Observation: Teacher group was more anxious.

(Continued)

Table 1  
Continued

First Author, Year	n & Student Characteristics	Intervention Focus & Methodology	Design & Duration	Treatment Measures, Effect Size (Positive ES Indicates Change in the Desired Direction)
Lal Zinta, 2008	n = 240	Focus: Guided mastery technique to reduce test anxiety	Quasi-experimental Design with 8 experimental conditions- two castes and 4 groups	All four high test-anxious groups decreased in test anxiety, whereas two of four low groups increased.
	Age: Not specified Grade: Senior secondary students Location/setting: India; Shimla Town	Methodology: Researcher administered, individual format. <i>Guided Mastery Task</i> : Students were presented with 20 anagrams during a session with the interventionist. The interventionist provided positive feedback and negative feedback to enhance accuracy. In addition, the interventionist provided guidance and encouragement when the student struggled, was off-task, or displayed helplessness.	1 session, duration unknown	Test Anxiety Inventory – Hindi Version (groups: High HTA, Low, LTA) General Self-Efficacy (groups: High HSE, Low, LSE) <i>Scheduled Caste</i> HSE-HTA, d = 1.02 LSE-HTA, d = 1.12 HSE-LTA, NS LSE-LTA, d = -0.92 <i>Nonscheduled Caste</i> HSE-HTA, d = 1.67 LSE-HTA, d = .45 HSE-LTA, d = -0.91 LSE-LTA, NS
Lang & Lang, 2010	n = 451	Focus: Increase perceptions of self-competence before taking an exam	Randomized controlled design (stratified cluster) with no treatment control	Posttreatment cognitive test anxiety significantly predicted test performance, but between group t-tests were not significant

(Continued)

Table 1  
Continued

First Author, Year	n & Student Characteristics	Intervention Focus & Methodology	Design & Duration	Treatment Measures, Effect Size (Positive ES Indicates Change in the Desired Direction)
Larson et al., 2010	<p>Age: Mean: 16.54</p> <p>Grades: Secondary and vocational students</p> <p>Location/setting: Germany</p> <p>Not specified</p>	<p><i>Methodology:</i> Researcher administered, classroom format. <i>Priming Competency:</i> Students were asked to think about a person who possessed skills in accurately solving scientific and technical problems. Students were then instructed to write down five to nine adjectives the individual possessed, five to nine adjectives regarding the personality and values of the individual, and three sentences about how this individual feels when they are about to solve difficult problems</p>	10 minutes	<p>Test Anxiety Inventory – German Version</p> <p>Task engagement and worry questionnaire</p> <p>Wilde Intelligence Test-2,</p> <p>Verbal-analogies subtest</p> <p>Wonderlic Personnel Test</p> <p>Cognitive, Grp 1, NS; Grp 2, NS</p> <p>Emotion, Grp 1, NS; Grp 2, NS</p> <p>Engagement, Grp 2, NS</p> <p>Worry, Grp 2, NS</p> <p>Predicting using cognitive test anxiety after intervention, <math>d = .78</math></p> <p>Predicting using cognitive test anxiety after intervention, <math>d = .75</math></p>
Larson et al., 2010	<p>Age: 8–10-year-olds</p> <p>Grade: Third grade</p> <p>Location/setting: Midwestern United States</p>	<p><i>Focus:</i> Reduction of anxiety before and during test taking</p> <p><i>Methodology:</i> Researcher administered, group format. <i>Elevator Breathing:</i> Relaxation intervention that includes diaphragmatic breathing and visualization. <i>Guided Relaxation for Children:</i> Progressive muscle relaxation intervention that required children to contract and relax various muscle groups and included deep breathing exercises</p>	<p>Quasi-experimental design with a no treatment control</p> <p>Ten sessions, unknown duration</p>	<p>Treated students in two groups reported less test anxiety from pre-post test, but there were no differences in test anxiety between control and experimental groups at posttreatment</p> <p>Westside Test Anxiety Scale, modified</p> <p>Total, Grp 1, <math>d = .23</math>;</p> <p>Grp 2, <math>d = .53</math></p>

(Continued)

Table 1  
Continued

First Author, Year	<i>n</i> & Student Characteristics	Intervention Focus & Methodology	Design & Duration	Treatment Measures, Effect Size (Positive ES Indicates Change in the Desired Direction)
Weems et al., 2009	<i>n</i> = 73	Focus: Reduction of test anxiety  <i>Methodology</i> : Researcher administered, group format. Intervention consisted of 1) Psychoeducation regarding anxiety, test anxiety, fear of evaluation, the normalcy of test anxiety, and cognitive and behavioral conceptualization of test anxiety, 2) Relaxation techniques, promotion of self-efficacy, and test-taking skills, 3) Test anxiety hierarchy exposure, 4) Review of sessions, and 5) Remaining exposure to hierarchy tasks	Quasi-experimental design with a wait-list control  Five sessions, unknown duration	Treated students reported less test anxiety, less PTSD symptoms, and higher GPAs pre-post treatment  Test Anxiety Scale for Children, modified Grade point average Posttraumatic Stress Reaction Index for Children, modified  Total, <i>d</i> = 1.2 GPA, <i>d</i> = 1.6 Total, <i>d</i> = .49
Yahav & Cohen, 2008	<i>n</i> = 2251	Focus: Reduction of anxiety and test anxiety	Randomized controlled design, with a no-treatment control  Eight, 60-minute sessions	Jewish and Arab groups experienced decreases in some variables in comparison to the no-treatment group. Arab students experienced more benefit.  State-Trait Anxiety Inventory for Children Test Anxiety Inventory New-Buss Hostility Questionnaire Eighteen Common Behavior Symptoms in Children Rosenberg Self-Esteem Scale  State-Arab, <i>d</i> = .56 State-Jewish, NS Total-Arab, <i>d</i> = .60 Total-Jewish, NS Hostility-Arab, NS Hostility-Jewish, <i>d</i> = .43 Behavior-Arab, <i>d</i> = .56 Behavior-Jewish, NS SE-Arab, NS SE-Jewish, NS
	Age: 14–16-year-olds Grade: Ninth <i>Location/setting</i> Israel; two major schools in a large city	<i>Methodology</i> : Researcher administered, group format. Cognitive behavioral and stress management intervention that consisted of: 1) Identification of the causes of stress and reactions to stress, 2) Instruction on the relationship between thoughts and emotions, 3) Psychoeducation regarding the cognitive model of stress, 4) Identifying stressors and using adaptive thoughts, and 5) Biofeedback computer program to enhance relaxation skills		

The between-group effect size was calculated using the following formula:

$$d_{\text{treatment-control}} = \frac{\bar{X}_{T2} - \bar{X}_{T1}}{S_p} \quad (1)$$

$$s_p = \sqrt{\frac{(N_{T2} - 1)SD_{T2}^2 + (N_{T1} - 1)SD_{T1}^2}{(N_{T2} - 1) + (N_{T1} - 1)}} \quad (2)$$

When regression was used, the effect size was calculated using the following formula:

$$d_{\text{treatment-control}} = \frac{B_{\text{unstandardized}}}{S_p} \quad (3)$$

The pretest to posttreatment ES was calculated using the following formula:

$$d_{\text{pre-post}} = \frac{\bar{X}_{T2} - \bar{X}_{T1}}{S_p} \quad (4)$$

$$S_p = \sqrt{(S_{T1}^2 + S_{T2}^2) / 2} \quad (5)$$

When ANOVA was used, the between-group effect size was calculated using the following formula:

$$d_{\text{treatment-control}} = 2\sqrt{\frac{F}{N}} \quad (6)$$

## RESULTS

### *Treatment Techniques*

Similar to the evidence-based treatments for generalized anxiety disorders, all of the test anxiety interventions identified in this review were grounded in cognitive or behavioral theory. One study used multiple cognitive-behavioral techniques (e.g., psychoeducation, relaxation techniques, exposure tasks, and rewards in comparison to no treatment; Weems et al., 2009), whereas another study compared cognitive-behavioral techniques without relaxation with relaxation alone, and an attention control (Gregor, 2005). One study each used systematic desensitization (Egbochuku & Obodo, 2005) or relaxation techniques alone (Larson, Ramahi, Conn, Estes, & Ghibellini, 2010). Two studies used biofeedback alone (Bradley et al., 2010) or in combination with cognitive-behavioral techniques (Yahav & Cohen, 2008). Two studies used academic strategy instruction (Carter et al., 2005) or remedial academic instruction in combination with self-instruction (Faber, 2010). Finally, one study used guided mastery techniques (Lal Zinta, 2008), and one used a priming competence technique (Lang & Lang, 2010). Nine of the 10 test anxiety interventions published between 2000 and 2010 indicate that behavioral, cognitive, cognitive-behavioral (CBT), and skill-building approaches to reducing test anxiety are effective for kindergarten to 12th-grade students. The following section will systematically review treatment outcomes by treatment type.

### *Treatment Outcomes*

Weems and colleagues (2009) found that a CBT intervention ( $ES = 1.2$ ) focused on reducing test anxiety for affected ninth-graders following Hurricane Katrina resulted in both significant reductions in test anxiety and posttraumatic stress disorder (PTSD) symptoms for treated youth as compared to students who did not receive the intervention. Additionally, only treated students

experienced a significant increase in their grade point averages (GPA), with intervention “help[ing] to normalize” the GPAs of test-anxious students (Weems et al., 2009, p. 224). Similarly, Gregor (2005) examined the impact of a cognitive-behavioral treatment program in reducing test anxiety among 11th-grade students. A unique aspect of Gregor’s study was that it included four groups, facilitating a comparison between four treatment types: CBT without relaxation, relaxation alone, CBT combined with relaxation, and attention control.

Following intervention, teachers rated students in the relaxation alone group, the CBT alone group, and the attention control group as having less anxiety, whereas teachers reported that the combined CBT and relaxation students experienced increased anxiety. Students did not report significant changes in test anxiety across all four groups. Additionally, the combined CBT and relaxation group performed better than expected on the math portion of the standardized test, whereas there were no differences between treatment groups’ performance on the English, technology, or science tests. These results led Gregor to conclude that a combined CBT and relaxation treatment is most effective for improving performance on standardized mathematics examinations. Although Gregor found that none of the treatments resulted in significant reductions in self-reported test anxiety, this study was implemented as a universal prevention treatment, and students without test anxiety may have masked test anxiety reductions among high test-anxious students such as those targeted in the Weems et al. study. Taken together, these two studies suggest different outcomes for multimethod cognitive-behavioral approaches in reducing test anxiety among high school students. Replications of multimethod CBT interventions are needed, along with interventions that attempt to determine what specific components of multimethod approaches result in treatment success.

Relaxation techniques alone were found to effectively reduce test anxiety in elementary school students in another study examining the effects of a universal treatment program. Larson and colleagues found that in comparison to no treatment control, self-reported levels of test anxiety significantly decreased among high school students who were taught diaphragmatic breathing and guided progressive muscle relaxation (Larson et al., 2010). This positive finding is supported by teacher-reported reductions in anxiety, but not self-reported anxiety among high school students within a relaxation-alone treatment group (Gregor, 2005). These two studies suggest positive treatment outcomes across universal prevention programs teaching students relaxation techniques.

Systematic desensitization alone, without other cognitive-behavioral techniques, was also found to be effective in reducing test anxiety and improving task performance in one study. Egbochuku and Obodo (2005) found that after a systematic desensitization intervention ( $ES = .70$ ), high school students with test anxiety intervention had lower test anxiety levels than students who did not receive the intervention. Systematic desensitization treatments involve the use of relaxation techniques during exposure to feared stimuli, that is, tests, to produce a counterconditioning effect that eventually weakens the relationship between the stimuli and the fear response. As such, this intervention program essentially combines the use of relaxation-alone techniques with exposure techniques, further supporting the use of relaxation alone with other behavioral and/or cognitive techniques to reduce student test anxiety.

Additionally, biofeedback techniques alone and in combination with cognitive-behavioral approaches were supported by promising results in two studies for high school students. Biofeedback techniques are a relatively new type of intervention that involves the use of physiological self-monitoring devices that provide users with real-time information about typically unconscious bodily processes, that is, heart rate, muscle tension, body temperature. With practice, users can exert control over these processes to attain greater levels of physiological relaxation. Students in the Bradley and colleagues (2010) biofeedback-alone study were found to more easily enter a relaxed state as measured by biological measures of heart rate and skin electrodermal activity (EDA) after receiving the biofeedback intervention than control students. Furthermore, students who received this

intervention reported significantly lower levels of test anxiety and negative affect than students who did not receive the intervention. Finally, intervention students performed significantly better on a high-stakes standardized English language assessment than the control group. Similarly, Yahav and Cohen (2008) implemented a combined biofeedback intervention along with CBT treatment. The authors found that adolescents who received the intervention displayed a significant reduction in test anxiety, state anxiety, and behavioral symptoms in comparison to the control group. Interestingly, success in altering EDA specifically through the biofeedback procedures was significantly related to a reduction in test anxiety and an increase in self-esteem, suggesting that the biofeedback component of the combined treatment was responsible for treatment outcomes. Together, these two studies strongly support the use of biofeedback strategies for reducing test anxiety among adolescents.

Two studies targeting students with identified disabilities used academic interventions to increase students' skills with the goal of decreasing test anxiety and increasing task performance. An intensive academic intervention study conducted by Faber (2010) found that an 80-hour individual intervention focused on teaching spelling techniques to students with dyslexia lowered spelling-specific test anxiety and increased students' scores on spelling achievement tests. Similarly, Carter and colleagues (2005) found that a 9-hour mathematics test-taking strategy intervention designed for two groups of students with learning disabilities, mild mental retardation, or language impairments resulted in significant increases in test performance for both treatment groups and significant decreases in test anxiety for one treatment group. These two studies suggest that skill-building interventions result in increased task performance and may result in associated decreases in test anxiety.

Finally, two studies used cognitive strategies to alter students' self-perceptions in order to decrease test anxiety and increase task performance among high school students. Lang and Lang (2010) examined the effect of a brief priming competence task that involved having students write about the characteristics they would expect to observe in someone who is good at solving science and technical problems and think about the qualities of successful people. Results suggest that the task resulted in increased test performance and task engagement for high test-anxious individuals and reduced performance for low test-anxious individuals in comparison to the control group. In contrast to the positive results found for the cognitive priming competence task, Lal Zinta (2008) found that a guided mastery technique involving encouragement, persuasion, and positive and negative feedback about performance on an anagram task did not result in reductions of test anxiety for treated students in comparison to controls. These different outcomes suggest that nonevaluative priming competence-based tasks may be more effective than evaluative tasks in reducing test anxiety.

## DISCUSSION

The purpose of this article was to systematically evaluate and identify effective interventions for test anxiety. Cizek and Burg (2006) have proposed that effective test anxiety interventions generally fall within one of five categories: behavioral, cognitive, cognitive-behavioral, study skills, and test-taking skills. Similarly, meta-analyses have identified cognitive, behavioral, and combined approaches to be effective in treating generalized anxiety disorders (Borkovec & Whisman, 1996; Gould et al., 1997). This review identified empirical support for several promising practices based in behavioral theory (Egbochuku & Obodo, 2005; Larson et al., 2010), cognitive theory (Lang & Lang, 2010), cognitive-behavioral theory (Gregor, 2005; Weems et al., 2009), and in the area of academic skill-building (Carter et al., 2005; Faber, 2010). One relatively new area of test anxiety intervention that has emerged is the use of biofeedback (Bradley et al., 2010; Yahav & Cohen, 2008). The use of biofeedback software in promoting greater conscious control over physiological processes in order to reduce general anxiety disorders is often paired with explicit instruction on relaxation techniques (e.g., Nassau, 2007). Specific to the treatment of test anxiety, the biofeedback software

program, emWave<sup>®</sup>, and the TestEdge<sup>®</sup> learning program have demonstrated positive outcomes for reducing test anxiety and increasing test performance; they can be purchased through the Institute of HeartMath ([www.heartmath.org](http://www.heartmath.org); Bradley et al., 2010).

### *Implications for School Psychologists*

As the use of large-scale standardized test outcomes to make high-stakes decisions about individual students and school systems continues to grow, so too does the pressure surrounding the testing environment. Nearly 25% of students were afflicted with high levels of test anxiety in a recent study (Bradley et al., 2007). However, schools are largely remiss in teaching children the skills necessary to understand and self-regulate the emotional stress and anxiety associated with testing (Greenberg et al., 2003; Mayer, Roberts, & Barsade, 2008), and there have only been four test anxiety treatment studies conducted in U.S. public schools published over the past decade. Moreover, students suffering from high levels of test anxiety perform poorly on tests (Hembree, 1988; McDonald, 2001), which may result in underestimates of student achievement and school effectiveness. School psychologists, as experts within the education system in testing, measurement, and mental health, have an important role to play in ensuring that students' test performance is reflective of their true academic ability through the prevention and treatment of test anxiety.

Within a tiered model of service delivery (e.g., Response to Intervention initiatives), school psychologists can act as leaders in the assessment and treatment of test anxiety. At the universal level, Weems and colleagues (2010) have provided a detailed and thorough description of a test anxiety prevention and intervention program through the University of New Orleans. Freely available test anxiety assessments such as the FRIEDBEN Test Anxiety Scale (Friedman & Bendas-Jacob, 1997) and Children's Test Anxiety Scale (Wren & Benson, 2004) can be used to screen large or targeted groups of students with relative ease and minimal intrusiveness. With this data in hand, school psychologists can identify targeted groups of students or test-anxious students for intervention support. At the group level, multimethod cognitive-behavioral interventions or more specific behavioral, cognitive, or academic interventions can be delivered to targeted classrooms or groups of students with high levels of test anxiety who have not responded to universal prevention and intervention efforts. At the most intensive individual level of service, relaxation training using biofeedback software may be used to teach physiological self-control and to evaluate intervention effectiveness for severely test-anxious individuals (Bradley et al., 2010).

## CONCLUSION AND FUTURE DIRECTIONS

With the increased reliance on large-scale testing outcomes for a variety of educational decisions, educators are obligated to ensure the authentic measurement of student achievement within these high-stakes situations. Minimizing test anxiety will help. School psychologists have a unique opportunity to help test-anxious students manage their anxiety and increase their academic performance. Furthermore, by addressing test anxiety in elementary and secondary schools at a systems level, school psychologists are acting to ensure that the data the school is reporting about the progress students are making is accurate and not diluted by aspects of examination anxiety. Accurate information regarding student knowledge can help schools, districts, and state education departments make informed decisions about where to focus valuable resources.

The evidence-based interventions reviewed in this article can be added to the school psychologist's toolbox to ensure the academic and emotional success of all children and schools. Additionally, there is a critical need for further research that examines the impact of test anxiety reduction programs at the universal, targeted, and tertiary levels for U.S. school children at the elementary, middle, and high school levels. In addition to the four U.S. treatment studies discussed in detail in this

review, the authors identified numerous promising U.S. test anxiety treatment studies that were not included due to a lack of data reporting or publication in a nonrefereed journal (e.g., Cheek et al., 2002; von der Embse, 2011; Weems et al., 2010). Practitioners in U.S. public schools are frequently faced with student test anxiety and they are limited by existing literature in making decisions about how to best treat these children, especially young children. We need to support the implementation and dissemination of research that advances school psychologists' knowledge and expertise in the treatment of test anxiety. Practitioners could compare the treatments identified in this review to the much broader evidence base for generalized anxiety disorders.

There are several limitations within the present study. First, a majority of the intervention procedures examined within this study have not been replicated. Therefore, more research needs to be completed to ensure that these are effective practices for school psychologists to implement with various populations. For example, Carter and colleagues (2005) examined the use of a skill-building intervention in a large urban school district. Although the authors found promising results in this setting, these findings may not generalize to other settings (e.g., rural schools). Second, a majority of these studies were conducted outside of the United States. Because school systems operate differently around the world and in different cultures, it is possible that an intervention that may effectively address test anxiety in another country may not be as effective in the United States because of varying contextual factors between the countries. Third, the research that was discussed in this review was obtained from articles that were published in English in peer-reviewed journals. Therefore, this review lacks information provided by unpublished dissertations or articles published in other languages.

#### REFERENCES

(Articles with \* indicate articles included in the review)

- Borkovec, T. D., & Costello, E. (1993). Efficacy of applied relaxation and cognitive behavioral therapy in the treatment of generalized anxiety disorder. *Journal of Consulting and Clinical Psychology, 61*, 611–619.
- Borkovec, T. D., & Whisman, M. A. (1996). Psychosocial treatment for generalized anxiety disorder. In M. Mavissakalian & R. Prien (Eds.), *Long-term treatment of anxiety disorders*. Washington, DC: American Psychiatric Association.
- Bradley, R., McCraty, R., Atkinson, M., Arguelles, L., Rees, R. A., & Tomasino, D. (2007). Reducing test anxiety and improving test performance in America's schools: Results from the TestEdge national demonstration study. Boulder Creek, CA: HeartMath Research Center, Institute of HeartMath, Publication No. 07-04-01.
- \* Bradley, R., McCraty, R., Atkinson, M., Tomasino, D., Daugherty, D., & Arguelles, L. (2010). Emotion self-regulation, psychophysiological coherence, and test anxiety: Results from an experiment using electrophysiological measures. *Applied Psychophysiology and Biofeedback, 35*, 261–283.
- \* Carter, E. W., Wehby, J., Hughes, C., Johnson, S. M., Plank, D. R., Barton-Arwood, S. M., et al. (2005). Preparing adolescents with high-incidence disabilities for high-stakes testing with strategy instruction. *Preventing School Failure, 49*, 55–62.
- Cheek, J. R., Bradley, L. J., Reynolds, J., & Coy, D. (2002). An intervention for helping elementary students reduce test anxiety. *Professional School Counseling, 6*(2), 162.
- Cizek, G., & Burg, S. (2006). *Addressing test anxiety in a high stakes environment*. Thousand Oaks, CA: Corwin Press.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Connor, M. J. (2003). Pupil stress and standard assessment tasks (SATs): An update. *Emotional and Behavioural Difficulties, 8*(2), 101–107.
- \* Egbochuku, E., & Obodo, B. (2005). Effects of systematic desensitisation (SD) therapy on the reduction of test anxiety among adolescents in Nigerian schools. *Journal of Instructional Psychology, 32*, 298–304.
- Ergene, T. (2003). Effective interventions on test anxiety reduction. *School Psychology International, 24*(3), 313–328.
- \* Faber, G. (2010). Enhancing orthographic competencies and reducing domain-specific test anxiety: The systematic use of algorithmic and self-instructional task formats in remedial spelling training. *International Journal of Special Education, 25*, 78–88.
- Friedman, I. A., & Bendas-Jacob, O. (1997). Measuring perceived test anxiety in adolescents: A self-report scale. *Educational and Psychological Measurement, 57*(6), 1035–1046.
- Gould, R. A., Otto, M. W., Pollack, M. H., & Yap, L. (1997). Cognitive behavioral and pharmacological treatment of generalized anxiety disorder: A preliminary meta-analysis. *Behavior Therapy, 28*, 285–305.

- Greenberg, M. T., Weissberg, R. P., O'Brien, M. U., Zins, J., Fredericks, L., Resnik, H., et al. (2003). Enhancing school-based prevention and youth development through coordinated social, emotional and academic learning. *American Psychologist*, 58, 466–474.
- \* Gregor, A. (2005). Examination anxiety: Live with it, control it or make it work for you? *School Psychology International*, 26, 617–635.
- Hembree, R. (1988). Correlates, causes, effects, and treatment of test anxiety. *Review of Educational Research*, 58(1), 47–77.
- Hurren, B. L., Rutledge, M., & Garvin, A. B. (2006). Team testing for individual success. *Phi Delta Kappan*, 87(6), 443–447.
- \* Lal Zinta, R. (2008). Effectiveness of guided mastery treatment for reducing test-anxiety among self-efficacious students. *Journal of the Indian Academy of Applied Psychology*, 34, 233–239.
- \* Lang, J., & Lang, J. (2010). Priming competence diminishes the link between cognitive test anxiety and test performance: Implications for the interpretation of test scores. *Psychological Science*, 21, 811–819.
- \* Larson, H., Ramahi, M., Conn, S., Estes, L., & Ghibellini, A. (2010). Reducing test anxiety among third grade students through the implementation of relaxation techniques. *Journal of School Counseling*, 8, 1–19.
- Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis* (Vol. 49). Thousand Oaks, CA: Sage Publications.
- Lowe, P. A., & Lee, S. W. (2008). Factor structure of the Test Anxiety Inventory for Children and Adolescents (TAICA): Scores across gender among students in elementary and secondary school settings. *Journal of Psychoeducational Assessment*, 26(3), 231–246.
- Lowe, P. A., Lee, S. W., Witteborg, K. M., Prichard, K. W., Luhr, M. E., Cullinan, C. M., et al. (2008). The Test Anxiety Inventory for Children and Adolescents (TAICA): Examination of the psychometric properties of a new multidimensional measure of test anxiety among elementary and secondary school students. *Journal of Psychoeducational Assessment*, 26(3), 215–230.
- Mayer, J. D., Roberts, R. D., & Barsade, S. G. (2008). Human abilities: Emotional intelligence. *Annual Review of Psychology*, 59, 507–536.
- McDonald, A. S. (2001). The prevalence and effects of test anxiety in school children. *Educational Psychology*, 21, 89–101.
- Nassau, J. (2007). Relaxation training and biofeedback in the treatment of childhood anxiety. *Brown University Child & Adolescent Behavior Letter*, 23(12), 1–7.
- No Child Left Behind Act of 2001, P.L. 107–110 C.F.R.
- Putwain, D. (2007). Test anxiety in UK schoolchildren: Prevalence and demographic patterns. *British Journal of Educational Psychology*, 77, 579–593.
- Putwain, D. (2008). Deconstructing test anxiety. *Emotional & Behavioural Difficulties*, 13, 141–155.
- Raffety, B. D., Smith, R. E., & Ptacek, J. T. (1997). Facilitating and debilitating trait anxiety, situational anxiety, and coping with an anticipated stressor: A process analysis. *Journal of Personality & Social Psychology*, 72, 892–906.
- Rosairio, P., Naez, J. C., Salgado, A., Gonzalez-Pianda, J. A., Valle, A., Joly, C., et al. (2008). Test anxiety: Associations with personal and family variables. *Psicothema*, 20(4), 563–570.
- Sapp, M., & Farrell, W. (1994). Cognitive-behavioral interventions: Applications for academically at-risk and special education students. *Preventing School Failure*, 38(2), 19–24.
- Segool, N., Carlson, J., Goforth, A., von der Embse, N., & Barterian, J. (2013). Heightened test anxiety among young children: Elementary school students' anxious responses to high-stakes testing. *Psychology in the Schools*, 50(1), XX–XX.
- Sena, J. D. W., Lowe, P. A., & Lee, S. W. (2007). Significant predictors of test anxiety among students with and without learning disabilities. *Journal of Learning Disabilities*, 40, 360–376.
- von der Embse, N. (2011). Evaluating a test anxiety intervention group in a high-stakes context. *The Ohio School Psychologist*, 56(2), 21–27.
- Weems, C., Scott, B., Taylor, L., Cannon, M., Romano, D., Perry, A., et al. (2010). Test anxiety prevention and intervention programs in schools: Program development and rationale. *School Mental Health*, 2, 62–71.
- \* Weems, C., Taylor, L., Costa, N., Marks, A., Romano, D., Verrett, S., et al. (2009). Effect of school-based test anxiety intervention in ethnic minority youth exposed to Hurricane Katrina. *Journal of Applied Developmental Psychology*, 30, 218–226.
- Wren, D. G., & Benson, J. (2004). Measuring test anxiety in children: Scale development and internal construct validation. *Anxiety, Stress, and Coping*, 17, 227–240.
- \* Yahav, R., & Cohen, M. (2008). Evaluation of a cognitive-behavioral intervention for adolescents. *International Journal of Stress Management*, 15, 173–188.
- Zeidner, M. (1990). Does test anxiety bias scholastic aptitude test performance by gender and sociocultural group?. *Journal of Personality Assessment*, 55, 145.
- Zeidner, M. (1998). *Test anxiety: The state of the art*. New York: Plenum Press.